

ANALYSIS OF INVESTOR OVERREACTION EFFECT AND RANDOM WALK: A CASE STUDY OF PAKISTAN STOCK EXCHANGE

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Abstract. *Research in behavioral finance put forward that in violation of Bayes' theorem rule and involving in Noise trading, majority of the investors in stock market tend to under react or overreact to unanticipated bad and good news. One of the investor anomalies "overreaction effect" in 30 firms listed in Pakistan Stock Exchange has been investigated in this study with the help of the portfolios of Loser and Winner Average Cumulative Abnormal Returns. Moreover, the Random Walk is checked over the average prices of the same 30 firms listed in Pakistan stock market. This research of market efficiency took stocks data of randomly selected 30 firms listed in Pakistan Stock Exchange on weekly basis whether such investor's anomalies affect stock prices. The result presents that there exist weak form of efficiency where the investor Overreaction present over many periods especially in global financial crises. Along with it, the Econometric test confirms the presence of Random Walk in the thirty firms of Pakistan Stock Market. Finally, the portfolios of loser Average Cumulative Abnormal Returns outperformed that of portfolios of winner Average Cumulative Abnormal Returns.*

Keywords: Under-reaction, over-reaction, loser and winner average cumulative abnormal returns, Pakistan Stock Exchange (PSE)

Introduction

The main theme of this research is to study and investigate the overreaction in different situations as well as Random Walk in the stock market. In history of efficient market hypothesis, in sixteenth century the prominent Italian mathematician Cardano (1564) wrote "*the most fundamental principle of all gambling is simply equal conditions of opponents, of bystanders, of money, of situation, of the dice box and the die itself, to the extent to which you depart from that equality, if it's in your opponent's favor, you are a fool, and if in your*

own, you are unjust". At another place he argued that "However there must be moderation of money involved; otherwise, it is certain that no one ever play". Further a French stock broker Jules Regnault observed that as long as an investor in the market holds a security, on the bases of price fluctuations of that security investor can lose or win; the price is directly proportional to the square root of time.

A general question, why do prices of stocks changes? There is no real and exact answer. Some states that prediction of stocks prices and understanding market movements is impossible and other predict it on the basis of past market data and trend. The stock market are sensitive to news as well as emotional market places that can be easily or up to some extent influenced by news which may be bad or good. The news has direct as well as indirect impact. Rules and regulations or any amendment made by regulatory body as Security Exchange Commission of Pakistan (SECP) can be considered directly influence on market and indirect influence can be from political, war nervousness of investor aspects which upset most of the investors in the market. So the indirect impact causes the fluctuation in the stock markets which are positively as well as adversely or decline the stock prices. These overreaction and under reaction of the investors are considered inconsistent with the efficient market hypothesis (EMH).

Psychologists studied stock market investor anomalies in the financial terminologies and presented the fact that there exists overreaction and under reaction of investors trading in stock market which contradict the efficient market hypothesis of Fama (1970). Sewell (2011) argues that most of the attacks on the efficient market hypothesis are in 1980s and 1990s. The market will be efficient if the price "fully reflects" the market information for investor (Fama 1970). One aspect is concerned with "fully", so it means that there should be no market that is ever efficient, suggesting the EMH will always false. Second aspect is that when a hypothesis is asymptotically correct considered the EMH is one of the true and strongest hypothesis in the field of social sciences. Efficient market is a worthy estimate of the stock market security intrinsic value at a specific period of time. The market efficiency is indispensable in a country because when the market is inefficient in adjustment to the new-fangled news, then the analysts/market proficient can outperform the stock market by receiving information about over and undervalued securities and as a result earns abnormal returns in that period (Mehmood, Mehmood, & Mujtaba, 2012).

For Pakistani market there are questions like: Does winner ACAR's perform better than loser ACAR's?; Is there any overreaction effect exist in

Pakistan stock market?; and does Pakistan Stock Exchange follow random walk?. This study is aimed at answering these questions.

Literature Review

Literature on Investor Overreaction

Schöler, Skiera, and Tellis (2014) study investigated that the average cumulative abnormal returns were recorded \$146 million and were twice as compared to western Europe. In response to financial innovation the average cumulative abnormal returns were higher in recession. Riskiness of financial innovation results in higher ACAR's while radicalness in financial innovation causes lower ACAR's in the period of recession. On the other hand, complexity causes lower ACAR's of the stock market while this is not the case with the investors in Pakistan stock market nor it financial innovation has any impact on investor tradings. Debondt (1985) argue that the prices of stock can be foreseen only on the basis of historical prices range from three to five years which contradict weak form of efficient market hypothesis as well as past loser portfolios outperform than the past winner portfolios by 25% which indicates that selling of winner shares and purchasing loser shares is profitable strategy. Additionally, it is claim that the overreaction occurrences sources past winner portfolios to be overpriced and loser portfolios in the past is to be underpriced besides investor overreaction is asymmetry. Benou and Richie (2003) study results were consistent with the overreaction hypotheses and having greater magnitude than those studies which were conducted in the past. The larger firm stock prices earned from 4 to 12 percent were more than expectation. Wiggernhorn and Madura (2005) evaluated the one day stock price movements which were reflected under or overreaction that resulted mispricing. Liquidity and information causes mispricing of newly public firms that consequently affected the degree of under or overreaction. Further, the winners portfolio exhibited underreaction during the quiet periods while showed no significant relationship during the lock up period and at last it indicated overreaction in the post- lock up period.

Hoitash and Krishnan (2008) studied the impact of noise of the prices on the stock returns in the market. It was investigated that the overreaction of investor was merely significant in high speculative intensity firms. Schaub, Lee and Chun (2008) examined the investors overreaction in the stock market of three countries Korea, Japan and Hong Kong over a long period of 1985 to 2005. The result shows that there is little or no reversals pursuing higher increase in stock prices while decline in stock prices have greater impact which were recorded from 35% to 45%. It explains that investors overreact mostly to bad news.

Ali, Ahmad and Anusakumar (2011) investigated investor overreaction in Bursa stock market, find that winner portfolios shows negative returns while loser portfolios shows positive returns. So, investors in the market can earn more than they invest in winner portfolios in short term. Gao and Oler (2011) investigated that all investors are rationally trading in the market and their response to rumours depends on market perceived overreaction. Ludwig and Zimper (2013) investigated that investor interpret incorrectly the future price that reflected underreaction of asset prices taking single period into consideration while reflected overreaction with numerous periods of good news.

Sohail and Javid (2014) found that in first four weeks winners portfolio stocks that exposed enormous price increase shows no significant affirmation of overreaction whereas the losers portfolio having large price fall likewise did not shows any significant affirmation of reaction of the financial crises in Pakistan. Later on the investors exhibit insignificant underreaction upto some level. Maheshwari and Dhankar (2014) judgmentally assesses the past three decades investor overreaction causes, effects and investor behavioral facets from diverse economies in the world discussed and investigate by different researchers. Contradict random walk preposition, recent study investigated that future stock prices are predictable. Efficient market hypothesis (EMH) fails to predict such anomalies. Soomro, Ahmed and Hussain (2015) found the evidence that there exist an evidence of investor overreaction in the five cement sectors listed in Pakistan Stock Exchange. Moreover, all the investor overreactions were statistically insignificant except eleventh and twelfth month.

Literature on Random Walk

Alexander (1961) elucidated the Random Walk Hypothesis that “a price is said to follow random walk if at any time the change to be expected can be represented by the result of tossing a coin, not necessarily a 50-50 coin, however, in particular, a random walk would imply that the next move of the speculative price is independent of all past moves or events”. While checking random walk model, there are too many tests present, like variance ratio test, unit root test and autocorrelation which is considered the best among all the mentioned tests?

Random walk was checked in the world equity markets using multiple VR tests before and after the financial crises. Results revealed that before and after the financial crises periods most of the developed and emerging markets follow random walk while on other side the random walk was not found in the Frontier markets. Emerging and developed markets faced greater changes in random walk than Frontier markets. Moreover, the multiple VR test in the

study appeared to have almost no effect on the results (Auer & Schuster, 2011). Time series dependencies in stock prices direction was checked in Bull and Bearish markets. Random walk was rejected in both Bull and Bearish market and GARCH model was found inconsistent in the long run Bull market (Lunde & Timmermann, 2012). Examining weak form efficiency in Australian stock market, the result found that serial correlation test exhibit weak form inefficiency in daily and border line efficiency in monthly stock returns. The unit root and run test shows that both monthly and daily returns in Australian stock market are weak form inefficient. Moreover, variance ratio tests shows that monthly returns were characterized by random walk while daily returns invades random walk and it's all due to short term correlation among those returns (Worthington & Higgs, 2009).

Random walk was applied in Korean Stock Exchange using multiple variance ratio tests using 5 regimes on daily stock prices. The result showed that the whole stock market approaching random walk. Applying price limits of +15% and -15% showed that there was little influence on stock prices to follow random walk (Ryoo & Smith, 2002). FTSE 100 index and AIM top 25 and bottom firms were investigated. The result showed that those FTSE larger companies are weak form efficient. So, someone using some trading rules can earn abnormal returns from these market inefficiencies. Along with it, the result presented that the stock information efficiency is more rampant when smaller the company (Bond & Dyson, 2008). Karan and Kapusuzoglu (2010) found that stock returns didn't withstand their levels of returns, which means that winner portfolio may not always become loser and loser may not always become winner in the succeeding periods in which portfolios were constructed. It was concluded that the portfolio constructed in Istanbul National Stock Exchange (ISE)-30 index followed random walk instead of exhibiting overreaction. So, investing in certain portfolio based on previous data may not always be profitable. Likewise, it is verified that ISE-30 index is weak form efficient market.

Hypotheses

H1: There exists investor overreaction effect in Pakistan stock market.

H2: Portfolio of loser ACAR's outperform than portfolio of winner ACAR's.

H3: The stock prices in Pakistan stock market follow random walk.

Investor Overreaction

The methodology of Debondt and Thaler (1985) is used in conducting this research to find the overreaction of investor. In the first stage Actual/Historical returns has to be calculated for the stocks.

$$R_{i,t} = P_t - P_{t-1} \quad (1)$$

Where $R_{i,t}$ is Actual or Historical returns, P_1 is the beginning value and P_{t-1} is the ending or later value. In the second phase the Expected stock returns is calculated where,

$$ER_{i,t} = 1/T \sum r_{i,t} \quad (2)$$

Where ER_i is the Expected Return and it was to be equal to the market index return $R_{m,t}$, T is the time period of the returns. $\sum r_{i,t}$ is the sum of returns “ i ” over the periods “ t ”. Further abnormal returns were calculated as below.

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \quad (3)$$

Where $AR_{i,t}$ is the abnormal return of stock “ i ” over the periods “ t ”. $R_{i,t}$ is the actual returns and $ER_{i,t}$ is the Expected return/ Market return. Further the Cumulative abnormal returns were calculated as below.

$$CAR_{i,t} = 1/15 \sum_{i=1}^N AR_{i,t} \quad (4)$$

$CAR_{i,t}$ is the cumulative abnormal return of stock “ i ” over the periods “ t ”.

$$ACAR_{i,t} = \sum_{i=1}^N CAR(i,t) \quad (5)$$

After finding average cumulative abnormal returns the first fifteen stocks which outperformed were considered “Winners” and fifteen stocks that underperformed/ show low performance were said “losers” stocks. Further the cumulative average abnormal returns were arranged in descending order to rank the fifteen winner stocks at the top that outperformed and fifteen loser stocks at the bottom that underperformed.

$$CAR_{i,t} = 1/15 \sum_{i=1}^{15} AR_{i,t} \quad (6)$$

$$ACAR_{loser} - ACAR_{winner} > 0 \text{ (Overreaction)}$$

Twelve years weekly data for the period of 2004 to 2016 is collected which is based on daily average stock prices of the thirty firms selected from Pakistan Stock Exchange based on the availability of their prices.

Kwiatkowski-Phillips-Schmidt-Shin Test

To find the random walk in the thirty firms listed in Pakistan Stock Exchange, one of the best and standard econometric unit root test that bring concrete and accurate results is utilized in the study. Kwiatkowski-Phillips-

Schmidt-Shin (KPSS) Test is also best and suitable like Augmented Duckier Fuller (ADF) test to check the stationarity in the series. The structural model uses by the test is given as;

$$y_t = c_t + \delta t + u_{1t} \quad c_t = c_{t-1} + u_{2t} \tag{1}$$

Results and Discussion

Table 1 *Descriptive Statistics Sample (2004-2016)*

Description	Value
Mean	-0.0218
Median	-0.019
Maximum	3.481
Minimum	-1.73
Standard Deviation	0.159
Kurtosis	2.7
Skewness	0.87
Count	21

Table 1 shows the distribution of data in which the values are in equal distance from the mean and have equal frequencies is said to be symmetrical. So parting from the symmetry caused Skewness. The coefficient generally varies from -3 to +3 and the sign indicates skewness direction like negative and positive skewness. This study picked 21 weeks randomly from the 500 weeks of average cumulative abnormal returns. Kurtosis shows degree of peakedness or flatness of the distribution and it is measured by the fourth standardized moment. When β_2 is equal to 3 then it shows normal distribution (mesokurtic, neither very peaked nor very flat), when β_2 is greater than 3 means more peakedness occur than normal, is said to be leptokurtic. When the curve is less than 3, shows narrower tails and more flatness than the normal curve is said to be platikurtic. Therefore the value of kurtosis given in the table explained that the distribution is platikurtic and the value of Skewness shows that the data is positively distributed. As both the values are somehow near to zero, it confirms that the data is almost normal and can be used to draw further inferences on the data. The twenty one exhibit number of observations (weeks) picked from 500 hundred weekly average cumulative abnormal returns.

Table 2 *Descriptive Statistics of ACAR's for Loser and Winner Portfolio*

	Winner Stock	Loser Stock
Mean	0.1455	-0. -0.2489
Median	0.0911	-0.1 -0.1875
Maximum	2.7643	0.15771
Minimum	-0.5173	-1. -1.7760

Standard Deviation	0.3175	0.2	0.2529
Skewness	0.8801	-1.	-0.9644
Kurtosis	2.913	6.1	2.431
Probability	0.000	0	0.000
Observations	21	20	21

Table 2 summarizes the average weekly average cumulative abnormal returns for the sample that includes of 21 observations (weeks). Mean value provides the average of the variable where winner ACAR's has mean (median) for the entire sample was 0-1455 (0.0911) and loser with mean (median) of -0.2489 (-0.2489). The table provides standard deviation for winner (loser) that is 0.3175 (0.2529) which elaborate that the winner ACAR's comprises of more risk than loser ACAR's. In the descriptive statistics, skewness value tells the range to which distribution of values deviates from symmetry around the mean. Kurtosis value is somehow near to zero which confirms that the data is normally distributed while the portfolio of winner average cumulative abnormal returns skewness value is positively skewed and the portfolio of loser average cumulative abnormal returns is negatively skewed.

Table 3 *Average Loser and Winner ACAR's and Overreaction Results with p-Value (2004-2016)*

Week	ACAR (W)	ACAR (L)	Loser-Winner	p-Value
1	-0.2146	-0.5734	-0.359***	0.000
24	0.0171	-0.0056	-0.023	0.345
48	-0.0660	-0.4863	-0.420***	0.000
72	0.1369	0.2622	0.125***	0.000
96	-0.4482	-0.8515	-0.403***	0.000
120	-0.0102	0.0651	0.075***	0.003
144	0.2688	0.0607	-0.208***	0.000
168	-0.0362	-0.2089	-0.173***	0.000
192	-0.0986	-0.0665	0.032	0.540
216	-0.3137	-0.6205	-0.307***	0.000
240	0.2548	0.2864	0.031	0.433
264	0.2270	0.1147	-0.112***	0.009
288	-0.0312	-0.1610	-0.130***	0.000
312	0.1666	0.0598	-0.107***	0.000
336	0.0102	0.2427	0.232***	0.000
360	0.2595	0.4410	0.181***	0.000
384	0.0706	0.0418	-0.029	0.390
408	-0.0492	-0.1130	-0.064*	0.094
432	-0.0608	-0.1132	-0.052	0.377
456	-0.1484	-0.5996	-0.451***	0.000
480	-0.0725	-0.2477	-0.175***	0.000

Note. ***, ** and * indicates significance at 1%, 5% and 10% level.

H1: There exists investor overreaction effect in the Pakistan stock market.

The results of investor overreaction effect in 30 companies listed in Pakistan stock market is shown in table 3. It reports winner and loser portfolios of average cumulative abnormal returns for 30 companies on weekly basis which is total of 500 weeks and 21 weeks is picked from week one to week 480 with the gap of 24 weeks in each. The highest average cumulative abnormal returns of winner portfolio are 26.88% in the stock market in week“144” while its lowest performance is in week 96 (-44.82%). On the other side loser portfolios of average cumulative abnormal returns highest performance is in week 360 (44.10%) while the lowest performance is in week 96(-85.15%).The result exhibits that there exists investor overreaction effect means that the difference of winner and loser average cumulative abnormal returns are positive in week 72 (12.5%), week 120 (7.5%), week 336 (23.2%) and in week 360 (18.1%) as well, which are highly statistically significant while the investor overreaction effect is also found in week 192 (3.2%) and in week 240 (3.1%) which is statistically insignificant. The result of the study presents that most of the investor overreaction effect is found in global financial crises which was started since 2007 till 2009. In week 01, 48, 96, 120, 168, 192, 216, 288, 408, 432, 456 and 480 the winners average cumulative abnormal returns are negative by -21.46%, -6.60%, -44.82%, -1.02%, -3.62%, -9.86%, -31.37%, -3.12%, 4.92%, 6.08%, 14.84% and 7.25% as well while positive in all other periods. The loser portfolio in the period of 01, 24, 48, 96, 168, 192, 216, 288, 408, 432, 456 and 480 which yields negative ACAR's in the market.

The difference between both the portfolios (loser ACAR's and winner ACAR's) when greater than zero illustrate overreaction, when equal to zero exhibit efficient market “where the portfolio of loser ACAR's become equal to that of the portfolio of winner ACAR's and both the portfolios earn equal returns”. In the third situation when the difference between them becomes negative then it tells that there exists under reaction in the stock market. In the whole period which is comprises of a decade, the research concluded that there exist over reaction in the 30 companies of the Pakistan stock market.

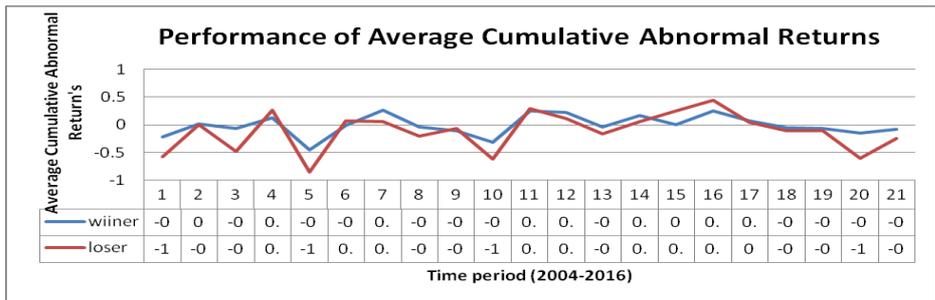


Figure 1. Performance of loser and winner portfolios of average cumulative abnormal returns.

H2: Portfolio of loser ACAR’s outperform than portfolio of winner ACAR’s.

The above graph exhibits average cumulative abnormal returns on Y-axis while the periods (weeks) on X-axis. As shown in the Figure 1 line graph and in the table 3 as well, the loser portfolio of average cumulative abnormal returns performed better as shown by the point 04, 06, 09, 11 and point 16 than the portfolios of winner average cumulative abnormal returns. The line graph shows that winners become losers and losers become winners at latter periods which confirm contrarian strategies of investors trading in the Pakistan stock market. In some situations the performance of average cumulative abnormal returns of loser portfolios becomes equal to that of the winners’ average cumulative abnormal return portfolios. It is proved by the results that investors in Pakistan stock market do focus at the news and outside economic situations and act accordingly to the news while trading in the stock market.

Table 4 Kwiatkowski-Phillips-Schmidt-Shin test

Variable	Level	First Diff,	Mackinnon Critical Values for Rejection of Hypothesis of a Unit Root			Decision	Order of Integration
			1%	5%	10%		
Average Stock Prices of 30 firms	1.306	0.131	0.249	0.136	0.141	Non-stationary at level but stationary at first difference	I (1)

H3: The stock prices in Pakistan stock market follow Random walk.

Table 4 exhibits the result of the random walk of the 2500 daily average stock prices Kwiatkowski-Phillips-Schmidt-Shin test statistic. The result presents that the 2500 daily average stock prices are found non-stationary at level where the value of “t” statistic calculated value is greater than the critical/tabulated values at 1%, 5% and 10% level as well but become stationary at first difference where the “t” statistic value is less than the critical/tabulated values.

Hence the results of time series unit root Kwiatkowski-Phillips-Schmidt-Shin test exhibits that the stock prices of thirty firms in Pakistan stock market follows random walk. The results of the study are consistent with the existing literature of (Karan & Kapusuzoglu, 2010; Mehmood, Mehmood & Mujtaba, 2012).

Conclusion

This research has investigated the investor’s overreaction which includes of winner and loser ACAR’s in 30 firms that are listed in Pakistan Stock Exchange. These analyses suggest that various firm’s stock returns exhibit patterns which are consistent with investor’s anomalies (under reaction and overreaction) in the stock market. The research investigated the investor overreaction where the loser ACAR’s outperform than that of the winner ACAR’s which is found/occurred in the whole period of the research. As this result is consistent with Wang, Burton, and Power (2006); according to whom overreaction occurred next to the formation period in single period across the entire study that were statistically significant. It was also the case with the Soomro, Ahmed and Hussain (2016) where investor’s overreact significantly only in the eleventh and twelfth months.

The research found the fact that there exist weak form of efficiency in Pakistan stock market where investor’s exhibits overreaction to the news at the time of trading in the stock market. This research is conducted in weak form of efficient market and in weak efficient stock market the investors do not receive enough information about stock returns and market tradings, as a result they do not respond rationally to the news. Overreaction is a situation in which investors reacts and responds more strongly than when it is necessary to the news they receive.

Implications

The suggestions of this research for managerial employees is that the managers who are managing and supervising different types of funds and portfolios of stocks remain active in order to generate positive returns and avoid losses while trading in the stock market. Doing so, they involve

subjectively in the process of trading of stocks. Thus the different anomalies effect their investment and selling decision of the stocks and as a result they face losses. Based on these findings this study has some implications for managers and investors like, managers should need to implement down side protection which might protect investor portfolios from extreme losses; and they should need to follow stop-loss strategy at time of trading which will provide higher returns in long run, lowers wild down movements in the value of portfolio.

The current study made contributions from investor anomalies aspect of the stock market in which thirty firms are targeted from almost all sectors of the Pakistan stock market over the period of twelve years from the period of 2004 to 2016. By finding the gap in the current study the academicians and scholars need to study the investor anomalies from other aspects and have to conduct research on the whole market. They can compare Pakistan Stock Exchange to other emerging as well as developed economies to get more generalized results. By studying investor's anomalies and random walk in the stock market, the researchers can provide remedies to avoid individual investors and firms from losses.

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